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Water Quality Indicators Guide:

Surface Waters

United States Department of Agriculture

Soil Conservation Service

Water Quality Indicators Guide: Surface Waters

Charles R. Terrell
National Water Quality Specialist
Ecological Sciences Division
Soil Conservation Service
Washington, D.C.

Dr. Patricia Bytnar Perfetti, Head
Departments of Geoscience and
Environmental Studies
Physics and Astronomy
University of Tennessee—Chattanooga
Chattanooga, Tennessee

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Soil Conservation Service
P.O. Box 2890
Washington, D.C.
20013

FOREWORD

With more than fifty years of experience in soil and related resources, the Soil Conservation Service (SCS) is actively involved in agriculturally related water quality issues. In recent years as the public has become concerned about surface and ground water problems, SCS has endeavored to meet water quality needs by developing and transferring new and innovative technologies. As part of that new effort the SCS has developed the Water Quality Indicators Guide: Surface Waters to aid in finding water quality solutions to problems from sediment, animal wastes, nutrients, pesticides, and salts.

With the creation of new laws, such as the Food Security Act of 1985 and the Water Quality Act of 1987, and many new regulations relating agriculture and water quality, SCS needs new tools to address water quality situations. The Water Quality Indicators Guide also helps fulfill the needs of educators for information and guidance to teach water quality in a clear and understandable manner.

The Water Quality Indicators Guide employs a simplified approach, allowing the user to learn the fundamental concepts of water quality assessment quickly. The guide extracts basic tenets from many disciplines, such as geology, hydrology, biology, ecology, and wastewater treatment, and focuses those ideas in making decisions about water quality. With the guide the user can assess potential water quality conditions without elaborate chemical testing procedures or intricate species identification. Then, the user can determine possible sources of the problem on adjacent lands, and recommend practices for correcting the condition.

The SCS has backed the guide's qualitative approach with the skills, knowledge, and experience of SCS biologists, hydrologists, water quality specialists and others from across the Nation. Our hope is that the Water Quality Indicators Guide: Surface Waters will prove to be a useful tool in making water quality assessments, leading to improved water quality and a better environment for all of us.

Robert R. Shaw

ROBERT R. SHAW
Deputy Chief for Technology
July 18, 1988

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Preface

The *Water Quality Indicators Guide: Surface Waters* is dedicated to Vernon M. Hicks, retired Soil Conservation Service (SCS) biologist, who fostered the idea of the guide when he was National Environmental Coordinator for SCS. As a result of many years of service in the South and the Northeastern United States, Mr. Hicks recognized the need for SCS field personnel to have a guide that allowed the user to recognize surface water quality problems easily but reliably, and to select conservation and best management practices that help remedy those problems. To date, few water quality publications have employed the indicator approach where environmental "surrogates" are used to represent pollution potentials. However, Mr. Hicks believed that environmental conditions could be surveyed without elaborate chemical testing procedures, and judgments made based on surrogates, concerning the quality of waters.

The core of the *Water Quality Indicators Guide* is the field sheets and list of associated practices to remedy or abate agricultural nonpoint source pollution. The field sheets are arranged in matrix format with environmental indicators given for sediment, animal wastes, nutrients, pesticides, and salts. Each indicator is divided into descriptions of the environment from excellent to poor, and each description is given a weighted numerical ranking. The user matches the individual description with what is observed in the water or on the land. By totaling the individual rankings, a score is obtained indicating the potential for agricultural nonpoint source problems. Practices can be selected from the list to alleviate problem situations.

With practice, the user of this guide will find that he or she can quickly learn water quality assessment procedures through the use of the guide's field sheets. With experience, the user's ability to assess water quality situations accurately with the field sheets will also increase. The guide is flexible, with places on the field sheets where the user can insert environmental surrogates representing local environmental conditions.

Charles R. Terrell
National Water Quality Specialist
Soil Conservation Service
United States Department of Agriculture
Washington, D.C.
July 18, 1988

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Introduction

Audience and Purpose of This Guide

The *Water Quality Indicators Guide: Surface Waters* is intended for the district conservationists and other field personnel of the Soil Conservation Service (SCS). It is designed to help field personnel recognize agricultural nonpoint source problems and their potential causes, and to give corrective measures. The Indicators Guide is meant to complement SCS's previously published *Water Quality Field Guide* (SCS-TP-160). Together, these two guides provide a comprehensive examination of surface water agricultural nonpoint problems and possible solutions.

The Role of the Soil Conservation Service in Water Quality

Throughout the history of the Soil Conservation Service, Congress has authorized SCS to provide water quality improvements through flood and pollution control. Much of SCS's work in water quality began in the early 1970's as a result of growing public concern about agriculturally related pollution. SCS assisted State and local efforts to develop agricultural plans under Section 208 of the Clean Water Act of 1977.

Both the Soil and Water Resources Conservation Act of 1977 and the Agriculture and Food Act (1981 farm bill) strengthened SCS's role in setting clean water objectives. More water efforts are cited in the Food Security Act of 1985 (1985 farm bill) that has important implications for SCS's future activities concerning water quantity and quality.

A Note to the User of This Guide

The *Water Quality Indicators Guide* examines five major sources of agriculturally related nonpoint source pollution—sediment, nutrients, animal waste, pesticides, and salts. Field sheets are provided to enable the user to assess surface water quality problems easily and accurately and to select appropriate remedial practices. The field sheet concept was adapted from a Wisconsin Department of Natural Resources methodology (ref. 1-1). The field sheets are completed in the field through onsite observations, rather than chemical or physical measurements. Conservation and best management practices (BMP's) are recommended to reduce or eliminate nonpoint source pollution originating from agricultural lands.

This type of approach may be sufficient in *some* instances to *confirm* that a particular nonpoint source pollution problem exists. In *other* instances, it may lead you to *suspect* a given pollutant, which can then be confirmed or denied by additional scientific analysis. When available, dissolved oxygen meters, salinity and conductivity meters, and field test kits may be used to supplement the *Water Quality Indicators Guide* field sheets. However, acceptable determinations can be made by using the field sheets without test kits or meters. When a particular nonpoint source pollutant is identified, the user of this guide is directed to possible solutions (conservation and best management practices), which are listed by number on the field sheets.

There are two types of field sheets: one type for receiving waters, including streams, rivers, lakes, and ponds; and another type for use on agricultural lands draining into the receiving waters. Chapter 1 reviews the overall distribution of agricultural nonpoint source problems. Chapter 2 gives a history of the water quality indicators approach and gives some general limitations of the *Water Quality Indicators Guide: Surface Waters*. Instructions for the water-based "A" type field sheets and for the land-based "B" type field sheets are contained in chapter 2. Chapter 3 presents background ecological information about aquatic ecosystems, especially stream systems.

Chapters 4 through 8 discuss the five major pollutants—sediment, nutrients, pesticides, animal wastes, and salts. These chapters discuss in detail the water quality indicators enumerated in the water-based "A" series of field sheets. It is assumed that Soil Conservation Service district conservationists and other field personnel will be familiar with the terminology given in the land-based "B" field sheets, so few specific instructions are given for the "B" field sheets. The "B" field sheets are designed to assess the pollutant generation potential of a particular field or pasture and are completed in the same way as the "A" field sheets. As an aid, a glossary of terms appears in appendix C.

Chapter 1

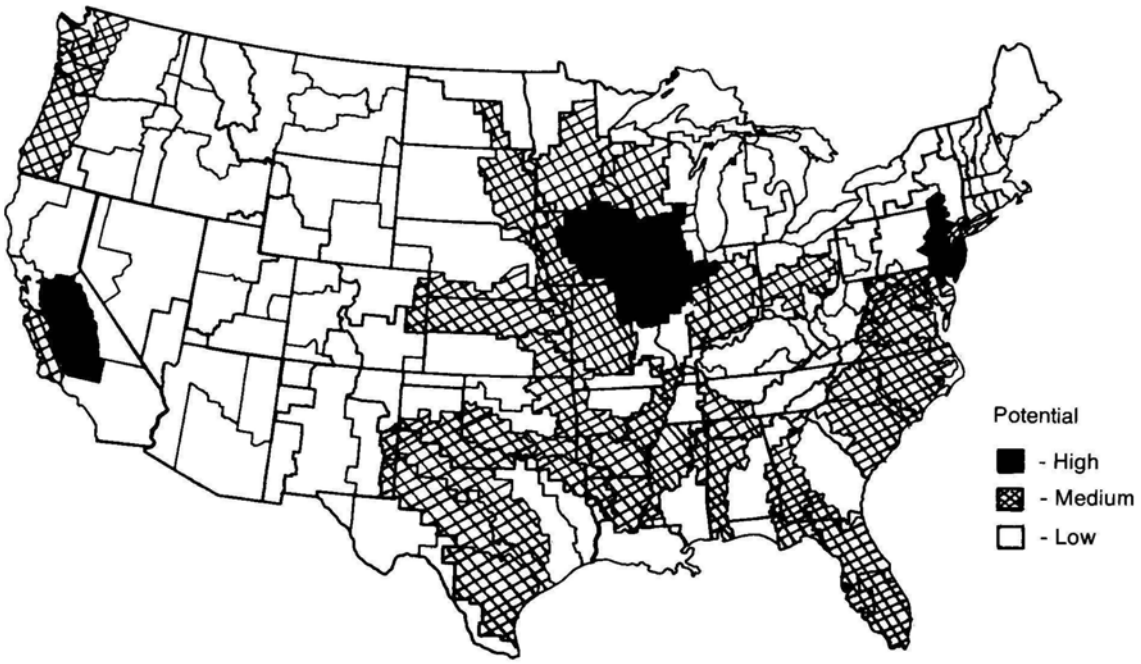
Pollution Related to Agriculture

Recent reports acknowledge that a principal water quality problem in our Nation is nonpoint source pollution. The U.S. Environmental Protection Agency defines nonpoint source (NPS) pollution as precipitation-driven stormwater runoff, generated by land-based activities, such as agriculture, construction, mining, and silviculture. Agricultural nonpoint sources are crop and animal production activities. These activities result in diffuse runoff, seepage, or percolation of pollutants from the land to surface and ground waters (ref. 1-2). Problems relating to agricultural nonpoint source pollution can be observed in the entire range of water bodies from estuaries to lakes and impoundments, to rivers, streams, and even farm ponds. Ground water is also vulnerable to pollution. Contaminated wells and drinking water supplies are now being identified.

In general, water quality problems result from five categories of agriculturally related nonpoint source pollution: sediment, nutrients, animal wastes, pesticides, and salts. Figure 1-1 shows the geographic potential for nonpoint source pollution of surface waters. The potential for agricultural nonpoint source pollution problems, according to SCS's Second Resources Conservation Act (RCA) Appraisal report (ref. 1-3), is shown in figures 1-2 through 1-7:

Figure 1-1

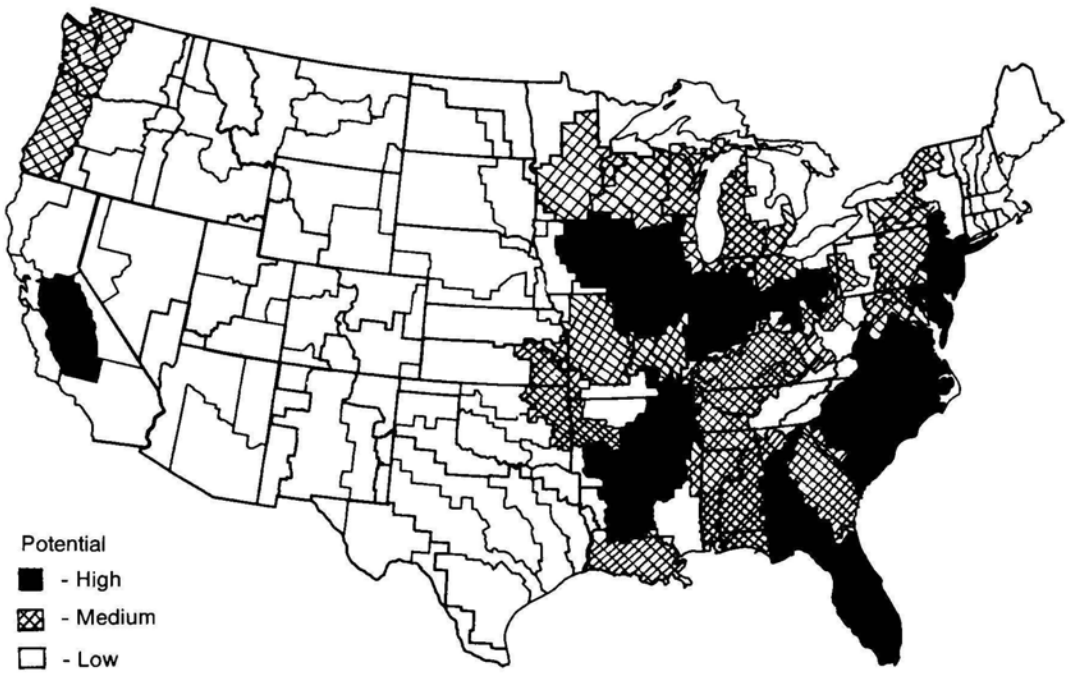
Composite Potential for Nonpoint Source Pollution of Surface Waters.



An area with a "low" composite rating could have a high rating for a specific contaminant. Ratings were made for multi-county watershed areas and do not identify more localized problems.

Figure 1-2

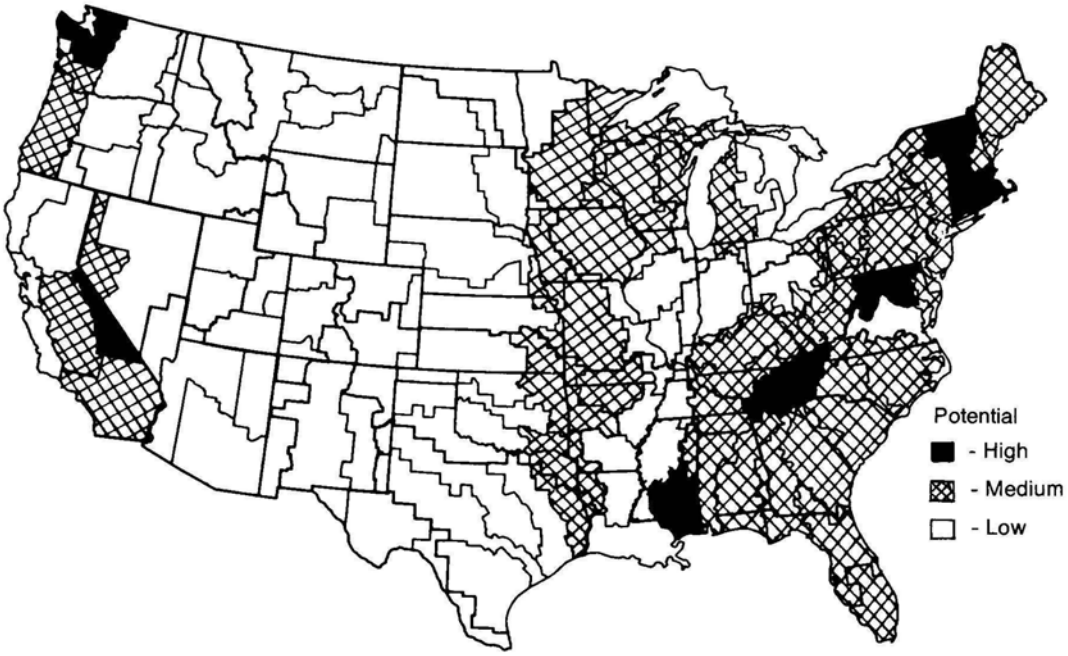
Potential for Pesticide Problems.



The potential for surface water pollution by pesticides was estimated by multiplying the crop acreages in each area by pesticide application coefficients for 184 pesticides. These values were multiplied by an availability factor that estimated the percentage of an application leaving a field and were adjusted by a runoff value for the growing season. Pollution potential is estimated for each watershed as a whole; localized conditions may be masked by aggregation. To confirm the existence of pesticide pollution, stream and lake monitoring would be necessary.

Figure 1-3

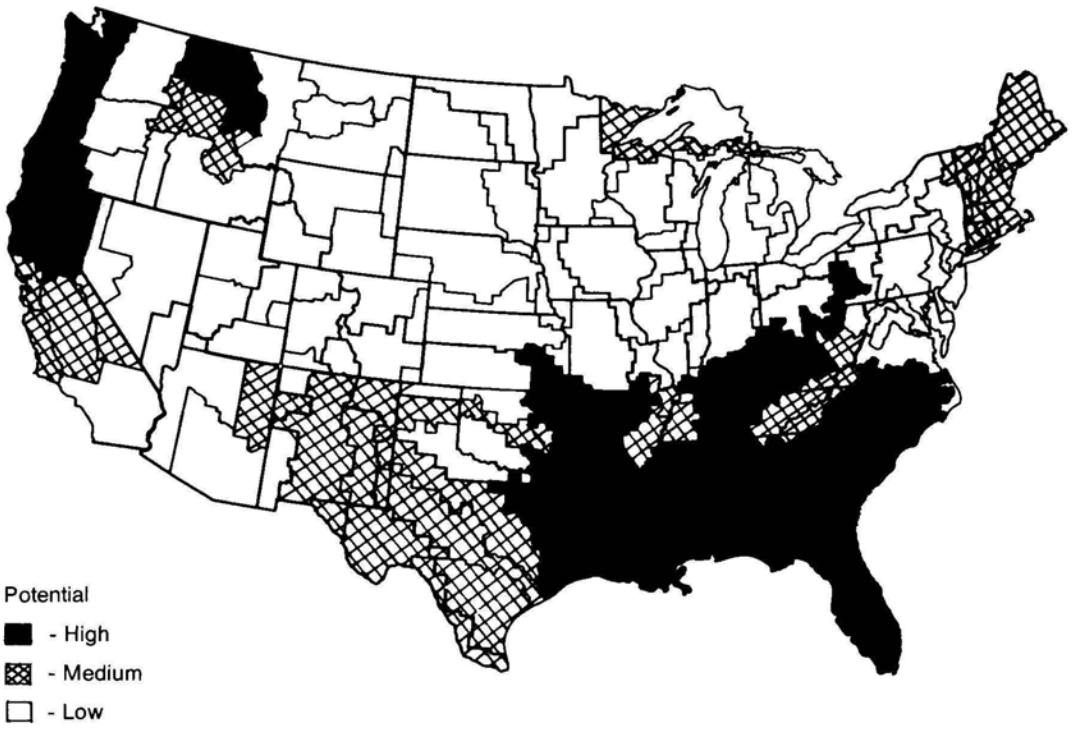
Tons of Manure Per Acre of Cropland and Grassland.



The number of each type of animal in a county (from the 1982 Agricultural Census) was multiplied by the appropriate manure production factor. The amounts of manure produced by all the county's livestock were totaled and aggregated by area; the total was divided by the acreage of cropland plus grassland (from the Agricultural Census) in each area.

Figure 1-4

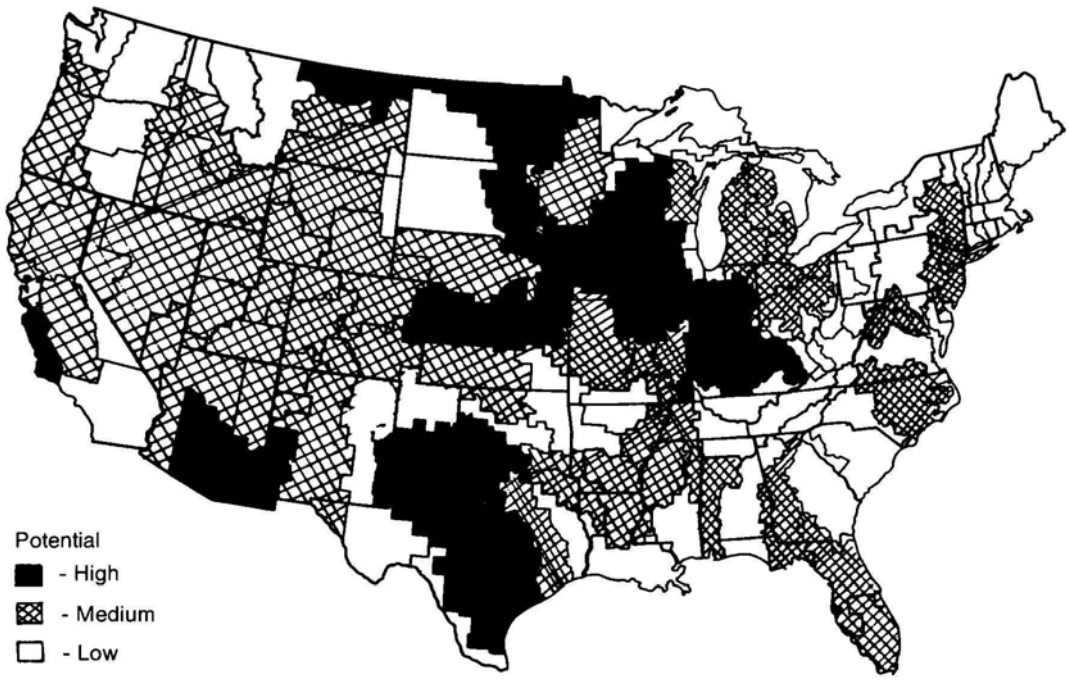
Potential for Animal Waste Problems.



The figure shows potential for pollution resulting from animal wastes, taking into account percentage of manure needing improved management, percentage of cropland and grassland associated with animal enterprises, runoff from precipitation, ratio of feed purchased to feed produced on farm, and ratio of nitrogen and phosphorus available from manure to nitrogen and phosphorus needed by crops.

Figure 1-5

Potential for Nutrient Problems.

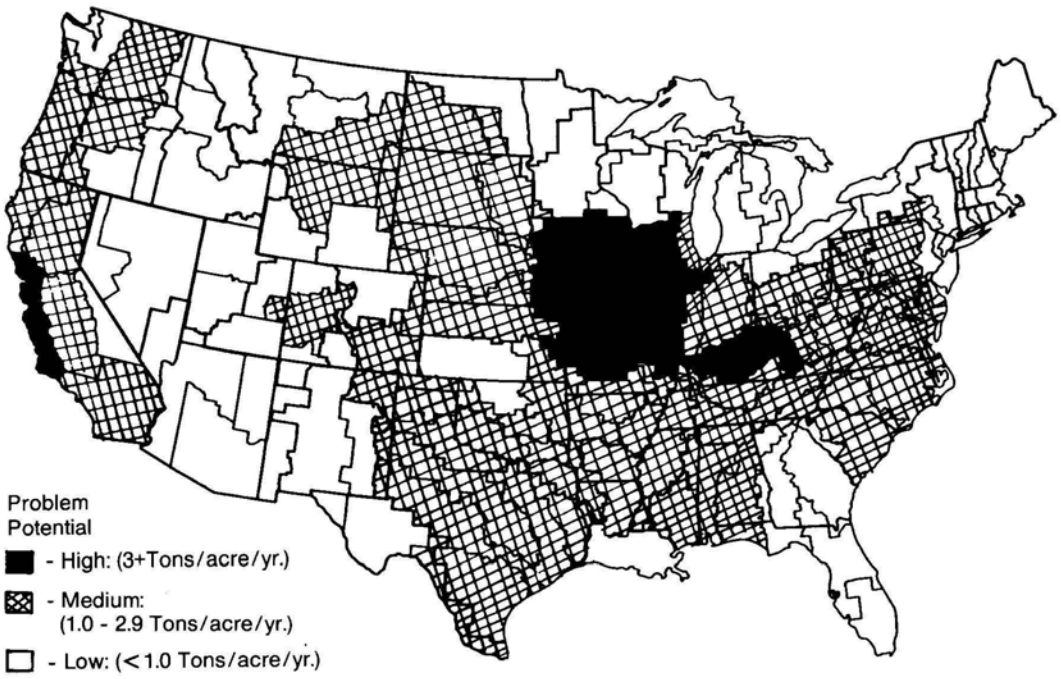


Source: WATSTORE (U.S. Geological Survey data from water quality stations, Ref. 1-4).

The potential for impairment of water quality was estimated by determining nutrient concentrations, by form, and comparing them with the respective threshold levels at which they threaten desired water uses. Data on nutrient concentrations were taken from WATSTORE (U.S. Geological Survey data from water quality stations). Stations were primarily National Stream Quality Accounting Network stations at the downstream and of hydrologic accounting units. Estimates of pollution potential are for the watershed as a whole and may not reflect localized conditions.

Figure 1-6

Estimated Sediment Yield.

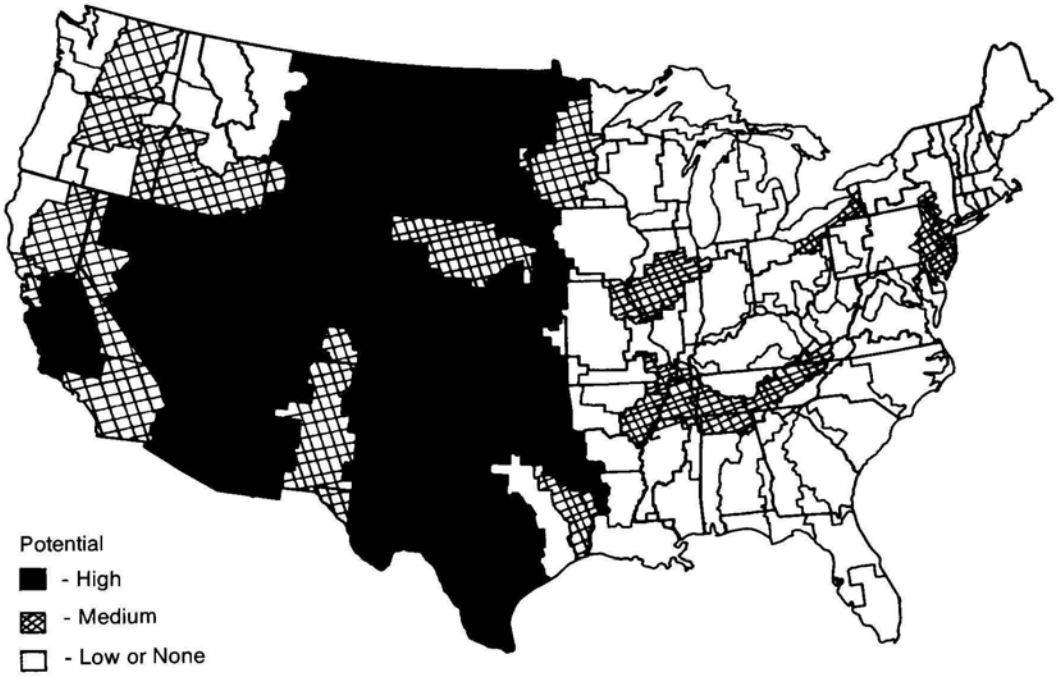


Sources: (1) 1982 National Resources Inventory (USDA-SCS, 1984, Ref. 1-5).
(2) USGS Surface Soil Surveys (Ref. 1-6).
(3) USDA Soil Survey Laboratory Data State Reports (Ref. 1-7).

Estimated sheet and rill erosion rates reported in the 1982 NRI were adjusted to county boundaries. Sediment delivery for each county and land use was estimated using state sediment delivery curves developed for the 1977 NRI. Sediment delivery rates are assumed to be higher in areas where streams are more numerous and closely spaced and where the surface soils have a higher percentage of fine particles (silt and clay). Data from USGS Surface Soil Surveys and USDA Soil Survey laboratory data were analyzed also.

Figure 1-7

Potential for Salinity Problems.



Sources: (1) U.S. Geological Survey National Stream Quality Accounting Network (NASQAN) stations in ASAs (Ref. 1-8).
(2) Published and unpublished data from EPA and USGS.

To assess potential, indicators of total dissolved solids, adjusted sodium adsorption, and chloride concentration were checked and total solid loads were analyzed using data for agricultural acreages, areas affected by saline or sodic soils, and irrigated acres as modifying and/or contributing factors. Data analyzed were taken from the U.S. Geological Survey National Stream Quality Accounting Network stations and published and unpublished data from EPA and USGS.

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Chapter 2

Water Quality Field Analysis

History of the Indicators Approach

Two centuries ago, when the U.S. population was small, the number of farmers and farm animals was also small. Agricultural wastes did not overload streams or other receiving water bodies. In those days, streams cleansed themselves naturally. Today, with the increasing complexity of farms, many watercourses and water bodies are unable to cope with the pollution loads being generated.

The SCS *Water Quality Indicators Guide: Surface Waters* is designed to determine by means of an indicators approach whether farm-generated materials are a problem. Water pollution investigators have used this type of approach since the turn of the century. At the heart of this approach is a comparison of water quality conditions above and below a suspected source of pollution. In most instances, the suspected source may be a "point" source pollution; that is, a type of pollution that can be readily identified as coming from a discrete source, such as a discharging pipe (e.g., a sewage outfall).

The *Water Quality Indicators Guide* adapts this approach for use with nonpoint source pollution—pollutants whose sources are diffuse and not readily identifiable. Nonpoint source pollutants include those substances which run off, wash off, or seep through the ground into receiving watercourses and water bodies. Agricultural nonpoint source pollution tends to wash or run off large tracts of cropland, pastures, feedlots, etc., and the conditions leading to pollution are highly variable.

One of the most important pollution variables is flow. In nonirrigated regions, loadings of the most common nonpoint source pollutants in a small stream tend to be proportional to the amount of runoff. Runoff, in turn, varies with conditions, such as: (1) amount of snowmelt or rainfall; (2) rate of snowmelt or rainfall; (3) soil type, condition, slope, vegetative cover, and land use; (4) time elapsed since the previous storm; and (5) seasonal timing and intensity of storm events.

Not only are the timing and extent of nonpoint source pollution events highly variable, but the effects of nonpoint source pollutants, either singly or in combination, are also variable. The effect of a given pollutant on water quality depends upon local site-specific environmental conditions; that is, on the local geology and the physical/chemical characteristics of the nearby water.

Both water quality and rate of flow influence the types of organisms that inhabit a given watercourse or water body. Organisms respond to many local environmental conditions, including climate, habitat availability, streambed type, etc. The ecology of watercourses is discussed in the next chapter.

Limitations of the Water Quality Indicators Guide

The *Water Quality Indicators Guide* was written to cover the entire United States, so it is general by intent. It can be expected that a particular stream or pond may deviate from the norms presented and will require the user to make adjustments for local situations. However, the guide has been field tested in five States across the Nation and by individual Soil Conservation Service personnel from many other States. The ideas, suggestions, and comments from those tests have been incorporated into this version. The *Indicators Guide* is not a research tool, nor does it give quantitative data, but as a qualitative tool and as an educational or learning device, it will aid the user in evaluating agricultural nonpoint source pollution problems.

This guide is especially limited where water flow rates are excessively low or high. In ephemeral or intermittent streams, some parts of this guide, such as observing fish, vegetation, or bottom invertebrates, cannot be used. The guide's use may be limited in heavily silted, mud-bottom streams, where the silt's presence provides an unsuitable habitat for many species. Also, heavy siltation of the water can "mask" the effects of nutrients that may be present, by shutting out light that normally would reach aquatic vegetation, allowing its growth. Thus, the vegetational part of the nutrient field sheet may not work well in heavily silted waters. In these cases, chemical testing may be necessary to determine nutrient levels.

Description of the Field Sheets

The heart of the *SCS Water Quality Indicators Guide: Surface Waters* is a series of field sheets (appendix F). The field sheets relate to surface water quality and are designed to help field personnel assess the degree of contribution to receiving waters from agriculturally related pollutants, namely sediment, animal waste, nutrients, pesticides, and salts. The receiving watercourses are natural streams, constructed channels, or receiving water bodies, such as ponds or lakes.

The field sheets are of two types: "A" and "B." The five "A" field sheets are designed to assess the effects of pollutants to receiving waters. These are water-based field sheets and should be completed onsite, following visual inspection of the receiving water.

By contrast, the seven "B" field sheets are land-based and are designed to assess the pollutant potential of a particular field or pasture; i.e., how likely it is that an agriculturally produced pollutant will be carried from a given field or pasture to a receiving watercourse or water body, or to ground water. There are more "B" field sheets than "A" sheets, because some land-based activities or environmental conditions required special emphasis.

Procedure for Field Analysis

NOTE: **Do not** write on the original field sheets. Make a copy of each field sheet before proceeding and write on the copies.

Step 1. Begin by completing the background information section (part 1) of the "Watershed Assessment." Although the Watershed Assessment was designed to be used with natural perennial streams, it can be adapted for use on either intermittent or ephemeral streams or on constructed waterways.

Please note that this evaluation cannot be made in the office. It must be made onsite, in the field. If you lack some of the necessary information, seek it from the landowner or operator, county agricultural extension agent, biologist, or other knowledgeable person.

Step 2. The "On-Farm (Ranch) Water Assessment" should be completed for each farm or ranch visited.

Step 3. Next, do a preliminary assessment of possible nonpoint source impacts by answering the questions asked in the "Watercourses" or "Water Bodies" Field Sheet Selection (part 2). If any of the questions in part 2 of the assessment receives a "yes" answer, then it is likely that the receiving water is being adversely affected by the pollutant indicated in the last column under the heading "Probable Cause." You

can verify this by completing the field sheets for this particular pollutant.

Please note that it is much easier to determine nonpoint source (NPS) pollution effects on standing (lentic) water, such as lakes or ponds, than for flowing (lotic) water, because standing water has a longer residence time (time that water remains in the water body), giving pollutants time to react.

Step 4. Proceed to the field sheets. If you are confident of your "no" answers in part 2 of the above assessment, you need to complete only those field sheets corresponding to the questions (pollutants) for which you marked either a "yes" or "can't tell" answer. For example, there will not be an animal waste problem if a particular farm or ranch has no animals and the owner or operator does not import animal waste. Obviously, in this case, none of the animal waste field sheets (2A, $2B_1$, $2B_2$) needs to be completed. If you are not confident that any of the pollutants should be eliminated as possible contributors of NPS pollution in a particular situation, complete all of the field sheets.

To learn how to use the sheets, it is recommended that you go through all of them at least once, including those for pollutants that have just a small possibility of affecting the watercourse or water body. This will allow you to gain familiarity with the sheets. With practice, using the sheets will become second nature to you, and you will complete them very quickly.

Filling Out the Field Sheets

TYPE A FIELD SHEETS

If upon completing part 2 of the watercourse (or water body) assessment you determined that sediment is probably adversely affecting the water, you should begin by focusing on the water-based Field Sheet 1A: "Sediment Indicators for Receiving Watercourses and Water Bodies (fig. 2–1)." Please take time now to look at this sheet. Outlined below is how you should use it. The sheet has answers circled in the way that should be done in the field.

For each field sheet, you are asked to complete the blanks at the top of the sheet which identify you, the evaluator, the county, State, etc. Notice that in the left column, Field Sheet 1A lists six different indicators or rating items with four possible options for item number 3. You will examine one indicator at a time and judge whether the water quality at this particular site ranks as excellent, good, fair, or poor regarding that particular indicator. Please note that these sheets should be completed in the field at the water's edge and *not* in the office.

A standing water body is fairly easy to assess for nonpoint source pollutant impacts. Flowing waters are not as easy to evaluate. The best place to observe a receiving watercourse is downstream of the pollutant sources. The exact point downstream from which to observe varies. If the water flow is very rapid, you may have to make observations at a distance downstream where the flow is slower. This is especially true when using the Nutrient Field Sheet (3A) because the effects from excessive nutrients often do not show in flowing waters until the flow rate is slow.

In completing Field Sheet 1A, it would be best to station yourself beside the stream (fig. 2–2) at the spot indicated by the *A. If the stream is flowing rapidly, flushing away pollutants very quickly, it may be necessary to walk downstream or upstream, observing indicators as you go. For ponds and lakes, it is best to observe from a site that allows a bird's-eye view of the whole water body, as well as from the water's edge.

The first indicator or ranking item on Field Sheet 1A for sediment is turbidity. Note that an indication of nonpoint source sediment pollution can most accurately be assessed only during or immediately following a storm event. Ask yourself, "What does the water look like at this particular site immediately after a storm?" Do you see "conditions normally expected under pristine conditions in your geographic region?" Is the water "clear or very slightly muddy after a storm event" or are "objects visible at depths greater than 3 to 6 feet (depending on water color)," such as described under the EXCELLENT heading? Or do the descriptors under the GOOD category more closely approximate conditions in your area; i.e., the water is "what is expected for *properly* managed agricultural land in your geographic region?" Is the water "a little muddy after a storm event but clears rapidly" or are "objects visible at depths between 1-1/2 to 3 feet (depending on water color)?" Are the conditions at this site better described by the descriptors under the headings of FAIR or POOR? Having read all four definitions under each of the four ratings, decide which of the four BEST describes the condition of the watercourse or body which you are evaluating and circle the number in the bottom of the box for that particular rating.

Follow the procedure outlined above for the turbidity parameter with each of the other five rating items on the Sediment Field Sheet 1A. When you have completed the entire sheet, add the circled numbers to obtain a total for the entire field sheet. This total should fall into one of the four ranking categories (excellent, good, fair, or poor) given at the very bottom of each field sheet. For example, if the total score was "8," record an "8/Poor" in the upper right-hand corner of the field sheet by "Total Score/Rank." What this says is that the water being evaluated is in a "poor" condition relative to sediment—or that sediment is greatly impacting the water at this site.

Design and Tailoring of the Indicator Guide Field Sheets To Fit Your Region

Please note that the field sheets are designed to be used for both flowing water and standing water across the entire United States. To use the sheets throughout this exceedingly diverse geographic area and for flowing and standing waters, it was necessary to include several descriptors per indicator (rating item) in each of the four categories (excellent, good, fair, and poor). These descriptors will rarely fit *all* given situations in a particular geographic area. In fact, some of the options within the same rank might at first appear contradictory if you fail to distinguish between standing and flowing water. Be especially careful when reading these descriptors and be sure to select the option which BEST or most closely matches the site specific conditions of the water you are assessing.

If the condition of the water in your locality *really* falls between two options or has about half of the characteristics of two options, you may "split" a score. You may want to add one or two other descriptors to all four options of a rating item. These

Figure 2-1

Sediment Page 1 of 2

Lat. 40° 37' 30"
Lon. 76° 40' 00"

FIELD SHEET 1A: SEDIMENT
INDICATORS FOR RECEIVING WATERCOURSES AND WATER BODIES

Evaluator Isaacs/Myers | County/State Dauphin, PA | Date 18 Apr. '88
Water Body Evaluated Pond | Water Body Location Lykens, PA | Total Score/Rank 24 · Good

Rating Item	Excellent	Good	Fair	Poor
	(Circle one number among the four choices in each row which BEST describes the conditions of the watercourse or water body being evaluated. If a condition has characteristics of two categories, you can "split" a score.)			
1. Turbidity (best observed immediately following a storm event)	What is expected under pristine conditions in your region. Clear or very slightly muddy after storm event. Objects visible at depths greater than 3 to 6 ft. (depending on water color). OTHER 9	What is expected for properly managed agricultural land in your region. A little muddy after storm event but clears rapidly. Objects visible at depths between 1½ to 3 ft. (depending on water color). OTHER (7)	A considerable increase in turbidity for your region. Considerable muddiness after a storm event. Stays slightly muddy most of the time. Objects visible to depths of ½ to 1½ ft. (depending on water color). OTHER 3	A significant increase in turbidity for your region. Very muddy—sediment stays suspended most of the time. Objects visible to depths less than ½ ft. (depending on water color). OTHER 0
2. Bank stability in your viewing area	Bank stabilized. No bank sloughing. Bank armored with vegetation, roots, brush, grass, etc. No exposed tree roots. OTHER 10	Some bank instability. Occasional sloughing. Bank well-vegetated. Some exposed tree roots. OTHER (7)	Bank instability common. Sloughing common. Bank sparsely vegetated. Many exposed tree roots & some fallen trees or missing fence corners, etc. Channel cross-section becomes more U-shaped as opposed to V-shaped. OTHER 4	Significant bank instability. Massive sloughing. No vegetation on bank. Many fallen trees, eroded culverts, downed fences, etc. Channel cross-section is U-shaped and stream course or gully may be meandering. OTHER 1
3. Deposition (Circle a number in only A, B, C, or D)	SELECT 3A OR 3B OR 3C OR 3D			
3A. Rock or gravel streams OR	A. For rock and gravel bottom streams: Less than 10% burial of gravels, cobbles, and rocks. Pools essentially sediment free. 9	A. For rock and gravel bottom streams: Between 10% & 25% burial of gravels, cobbles, & rocks. Pools with light dusting of sediment. 7	A. For rock & gravel bottom streams: Between 25% and 50% burial of gravels, cobbles and rock. Pools with a heavy coating of sediment. 3	A. For rock & gravel bottom streams: Greater than 50% burial of gravels, cobbles and rocks. Few if any deep pools present. 1
3B. Sandy bottom streams OR	B. For sandy streambeds: Sand bars stable and completely vegetated. No mudcaps or "drapes" (coverings of fine mud). No mud plastering of banks; exposed parent material. No deltas. 9	B. For sandy streambeds: Sand bars essentially stable and well, but not completely, vegetated. Occasional mudcaps or "drapes." Some mud plastering of banks. Beginnings of delta formation. 7	B. For sandy streambeds: Sand bars unstable with sparse vegetation. Mudcaps or "drapes" common. Considerable mud plastering of banks. Significant delta formation. 3	B. For sandy streambeds: Sand bars unstable and actively moving with no vegetation. Extensive mudcaps or "drapes." Extensive mud plastering of banks. Extensive deltas. 1
3C. Mud-bottom streams OR	C. For mud bottom streams: Dark brown/black tanic-colored water (due to presence of lignins and tanins). Abundant emergent rooted aquatics or floating vegetation. 9	C. For mud bottom streams: Dark brown colored water. 7	C. For mud bottom streams: Medium brown water, muddy bottom. 3	C. For mud bottom streams: Light brown colored, very muddy bottom. 1

Figure 2-1

Sediment Page 2 of 2

FIELD SHEET 1A: SEDIMENT, Continued
INDICATORS FOR RECEIVING WATERCOURSES AND WATER BODIES

Rating Item	Excellent	Good	Fair	Poor
3D. Ponds	Ponds essentially sediment free. No reduction in pond storage capacity. OTHER 9	Ponds with light dusting of sediment. Very little loss in pond storage capacity. OTHER 7	Ponds with a heavy coating of sediment. Some measurable loss in pond storage capacity. OTHER (3)	Ponds filled with sediment. Significant reduction in pool storage capacity. OTHER 1
4. Type and amount of aquatic vegetation & condition of periphyton (plants, growing on other plants, twigs, stones, etc.)	Periphyton bright green to black. Robust. Abundant emergent rooted aquatics or shoreline vegetation. In ponds, emergent rooted aquatics (e.g. cattails, arrowhead, pickerelweed, etc.) present, but in localized patches. OTHER 9	Periphyton pale green and spindly. Emergent rooted aquatics or shoreline vegetation common. In ponds, emergent rooted aquatics common, but confined to well-defined band along shore. OTHER (7)	Periphyton very light colored or brownish and significantly dwarfed. Sparse vegetation. In ponds, emergent rooted aquatics abundant in wide bank; encroachment of dry land species (grasses, etc.) along shore. OTHER 5	No periphyton. No vegetation. In ponds, emergent rooted aquatics predominant with heavy encroachment of dry land species. OTHER 2
OPTIONAL: 5. Bottom stability of streams	Stable. Less than 5% of stream reach has evidence of scouring or silting. OTHER 9	Slight fluctuation of streambed up or down (aggradation or degradation). Between 5-30% of stream reach has evidence of scouring or silting. OTHER 7	Considerable fluctuation of streambed up or down (aggradation or degradation). Scoured or silted areas covering 30-50% of evaluated stream reach. Flooding more common than usual. More stream braiding than usual for region. OTHER 3	Significant fluctuation of streambed up or down (aggradation or degradation). More than 50% of stream reach affected by scouring or deposition. Flooding very common. Significantly more stream braiding than usual for region. OTHER 1
OPTIONAL: 6. Bottom dwelling aquatic organisms	Intolerant species occur: mayflies, stonefiles, caddisflies, water penny, riffle beetle and a mix of tolerants. High diversity. OTHER 9	A mix of tolerants: shrimp, damselflies, dragonflies, black flies. Intolerants rare. Moderate diversity. OTHER 7	Many tolerants (snails, shrimp, damselflies, dragon flies, black flies). Mainly tolerants and some very tolerants. Intolerants rare. Reduced diversity with occasional upsurges of tolerants, e.g. tube worms and chironomids. OTHER 3	Only tolerants or very tolerants: midges, craneflies, horseflies, rat-tailed maggots, or none at all. Very reduced diversity; upsurges of very tolerants common. OTHER 1

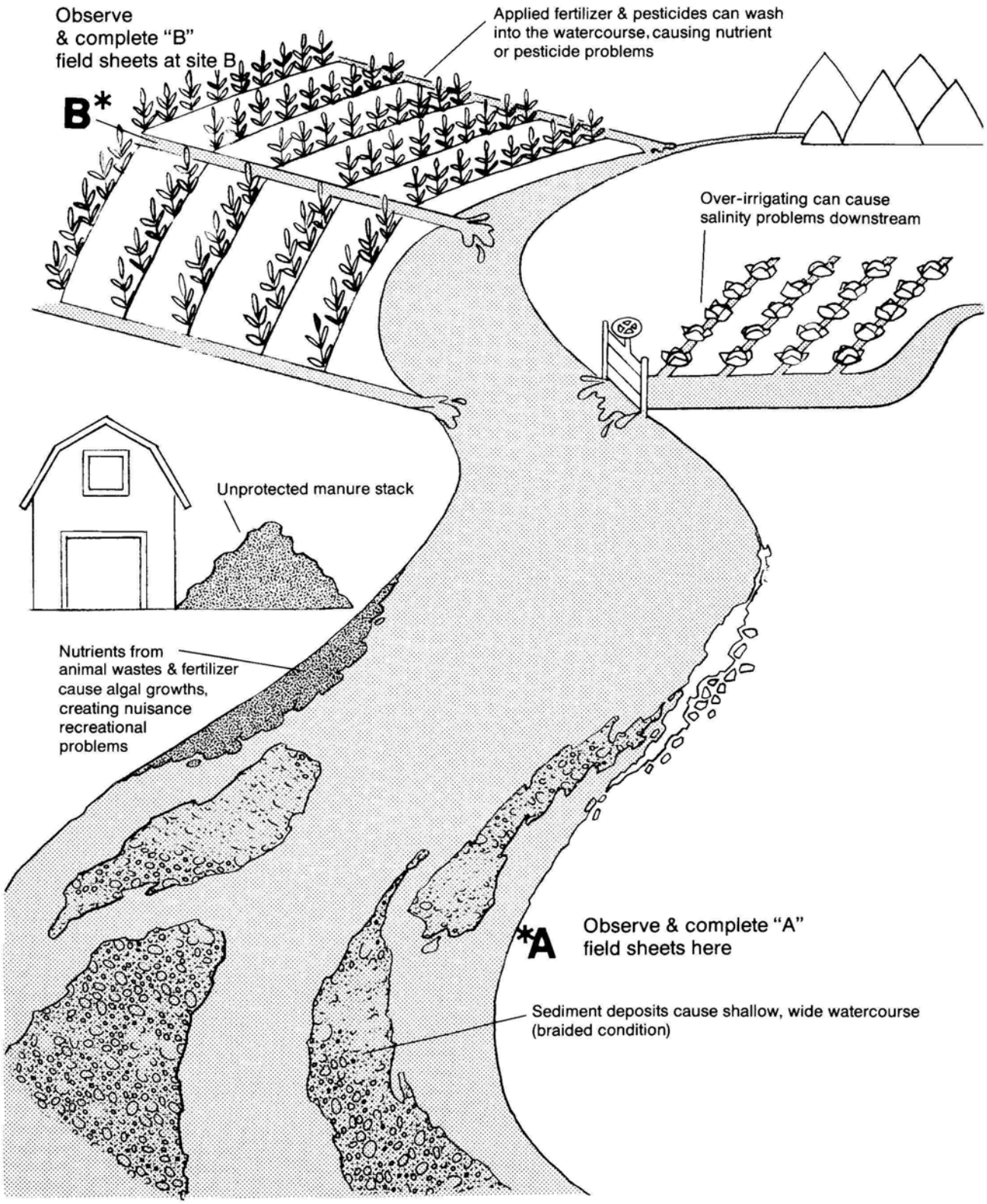
TOTAL [24]

1. Add the circled Rating Item scores to get a total for the field sheet.
2. Check the ranking for this site based on the total field score. (Check "excellent" if the score totals at least 32. Check "good" if the score falls between 21 and 31, etc.). Record your total score and rank (excellent, good, etc.) in the upper right-hand corner of the field sheet. If a Rating Item is "fair" or "poor," complete Field Sheet 1B.

RANKING	Excellent (32-37) [ ]	Good (21-31) [24]	Fair (9-20) [ ]	Poor (8 or less) [ ]
OPTIONAL RANKING (with #5 OR #6)	Excellent (40-46) [ ]	Good (26-39) [ ]	Fair (11-25) [ ]	Poor (10 or less) [ ]
OPTIONAL RANKING (with #5 AND #6)	Excellent (48-55) [ ]	Good (31-47) [ ]	Fair (13-30) [ ]	Poor (12 or less) [ ]

Figure 2-2

Nonpoint Source Pollution Effects.



other options apply to your particular geographic region and precisely define particular water quality situations. The word "OTHER" that has been included in each block on each field sheet means that you are free to adapt the field sheets to your particular region or locale. Note also that if none of the descriptors fit, you can resort to rankings relative to your geographic region, such as the first ones given for the turbidity indicator on Field Sheet 1A: Sediment.

One last point—A field sheet, like any other tool or instrument, is only as good as the person using it. This is true of the use of these field sheets. Those who take the time to learn how to use the *Water Quality Indicators Guide* field sheets will quickly become proficient in their use. Based on your experience with the sheets, you will start to make judgments about water quality and will develop an "intuitive feel" for the water's condition. *Rely on this judgment,* even if it means altering the field sheets.

Remember that the field sheets are only as good a tool as you make them, especially concerning local conditions.

Given that water is severely polluted by sediment, how can we know that the sediment is coming from agriculturally related activities? If it is related to agriculture, how can we correct the problem and improve water quality? To answer these questions, turn to the "B" field sheets.

TYPE B FIELD SHEETS

Assumption. Before using the series "B" field sheets, it is important to recognize that underlying the design of the overall field analysis is the assumption that we are striving for water of fishable/swimmable qualities—a goal established in the Federal Water Pollution Control Act of 1972 and iterated in the 1987 Water Quality Act Amendments. While geographic and site-specific conditions might cause us to accept a "good" rating in some instances, we should not be satisfied with a water quality rating of "fair" or "poor."

The "B" field sheets should be completed in all cases where water quality ranks lower than what is expected regionally under naturally occurring pristine conditions for any of the five major agricultural pollutants. While in many cases the pristine condition will receive an excellent rating, in other cases naturally occurring conditions (geologic, topographic, etc.) prevent the waters from ever being "excellent" (fishable/swimmable). It is important to be able to distinguish between naturally occurring and human-induced limitations to water use. It may be difficult to determine what constitutes "pristine" conditions for your area. If you do not know or are not sure, be sure to consult with local experts in the water quality field. Call the SCS State Office Water Quality Specialist or Biologist or the specialists at the SCS National Technical Centers. Every State has a water pollution control agency, although the names vary. Specialists in these offices are most willing to assist. Additionally, many local colleges and universities have environmental and water quality experts who can be of great help.

The "B" field sheets allow an on-farm or on-ranch assessment (fig. 2–3) of the five major agriculturally related contributors of pollution. Recommendations for improving problem situations are given in the last column of each sheet under "Practices from appendix E" (conservation and best management practices, ref. B–6). Figure 2–3 is completed with circled answers in the way that was done on Field Sheet 1A.

Other than the list of conservation and best management practices (BMP's) in the last column, the format for the "B" series is identical to that for the "A" series. Therefore, the procedure outlined above for use with the "A" field sheets should also be used in completing the "B" sheets.

The "B" sheets should be completed onsite. If a conservation plan exists for a given property, it would be helpful to have it in hand while completing the "B" field sheets. A soil survey of the area would also be helpful if you are not familiar with the land tract. You may want to briefly reconnoiter the tract of land. Previous experience with this particular property owner or manager and prior knowledge of the property will prove invaluable.

Based on your previous knowledge of the land or your recent reconnaissance, define a "representative" field which drains into a watercourse or water body you have judged to be polluted by use of the "A" field sheets. That is, choose an area large enough to give an appropriate numerical weighting to both properly and poorly managed areas. Then proceed to complete the appropriate "B" field sheet relative to the field that you just defined. While a sample field size should be representative, it is recommended to select for your observation site a location where you could expect to find a pollutant. For example, if you were assessing nutrients or pesticides, you might stand in the middle of the row crops, as shown in figure 2–2, where the B* is indicated. If you were interested in sediment pollution, you might position yourself in or near a recently plowed field.

If scores for any of the indicators (rating items) were ranked less than "good" or "excellent," you will want to consider recommending to the property owner or user one or more of the conservation or BMP's listed in the right-hand column of the sheet for that particular rating item. The practices listed are by no means exhaustive and may not be entirely suitable to your locality. Therefore, you will need to evaluate the suggested practices, selecting those that you consider to be appropriate to the given situation and adding others that may be lacking.

Figure 2-3

Sediment

Lat. 40° 37' 30"
Lon. 76° 40' 00"

FIELD SHEET 1B: SEDIMENT
INDICATORS FOR CROPLAND, HAYLAND OR PASTURE

Evaluator Isaacs/Myers — County/State Dauphin, PA — Date 18 Apr. '88
Field Evaluated Wilson — Field Location Lykens, PA — Total Score/Rank 30 Good

Rating Item	Excellent	Good	Fair	Poor	Practices from Appendix E
	(Circle one number among the four choices in each row which BEST describes the conditions of the field or area being evaluated. If a condition has characteristics of two categories, you can "split" a score.)				
1. Erosion Potential	-- Not significant. -- Less than T (tolerance); little sheet, rill, or furrow erosion. -- No gullies. -- OTHER 10	-- Some erosion evident. -- About T; some sheet, rill, or furrow erosion. -- Very few gullies. -- OTHER (7)	-- Moderate erosion. -- T to 2T. -- Gullies or furrows from heavy storm events obvious. -- OTHER 3	-- Heavy erosion. -- More than 2T. -- Many gullies or furrows & presence of critical erosion areas. -- OTHER 0	1,3,5,7,8, 9,10,11, 15,16,17, 18,19,20, 21,22,23, 24,25,26, 27,29,30, 31,32,33, 37,38,40, 45,46,54, 61,62,65, 69,70,73, 75,79,85, 87,95,97, 99,102
2. Runoff Potential	Low: -- Very flat to flat terrain (0-0.5% slope). -- Runoff curve number (RCN) 61 - 70. -- Dry, low rainfall (less than 20"). -- Even, gentle impact (scattered shower-type) rainfall. -- OTHER 10	Moderate: -- Flat to gently sloping (0.5-2.0% slope). -- RCN 71 - 80. -- Semidry (20-30"). -- Even, gentle to moderate intensity rainfall. -- OTHER (8)	Considerable: -- Gently to moderately sloping (2.0-5.0% slope). -- RCN 81 - 90. -- Semiwet (30-40"). -- Even to uneven intense rainfall. -- OTHER 4	High: -- Moderately sloping to steep terrain (greater than 5%). -- RCN greater than 90. -- Wet (more than 40"). -- Intense uneven rainfall, especially in seasons when soil is exposed. -- OTHER 0	6,9,88,95
3. Filtering effect or sedimentation potential of a vegetated buffer or water/sediment collecting basin	-- Intervening vegetation between cropland & watercourse greater than 200 ft. -- Type of intervening vegetation ungrazed woodland, brush, or herbaceous plants. -- Water & sediment control basins properly installed & maintained. -- OTHER 8	-- Intervening vegetation between cropland & watercourse 100 to 200 ft. -- Type of intervening vegetation grazed woodland, brush, or herbaceous plants or range. -- Water & sediment control basins properly installed, but poorly maintained. -- OTHER 6	-- Intervening vegetation between cropland & watercourse 50 to 100 ft. -- Type of intervening vegetation high density cropland. -- Water & sediment control basins poorly installed & poorly maintained. -- OTHER (4)	-- Cropping from less than 50 ft up to water's edge. -- Type of intervening vegetation low density cropland or bare soil. -- No water & sediment control basins. -- OTHER 2	5,18,25, 27,79,107
4. Resource management systems (RMS's) on whole farm (combined value for all agricultural areas	-- Excellent management. -- RMS's always used as needed. -- OTHER 9	-- Good management. -- Most (80%) of the needed RMS's installed. -- OTHER (7)	-- Fair management. -- About 50% of the needed RMS's installed. -- Cropping confined to proper land class. -- OTHER 3	-- Poor management. -- Few, if any, needed RMS's installed. -- Cropping not confined to proper classes. -- OTHER 0	Practices same as Rating Item #1
5. Potential for ground water contamination	LOW: -- Soils rich to very rich in organic matter (greater than 3.0%). -- Slow to very slow percolation in light textured soils such as clays, silty or sandy clays, or silty clay loams. -- Perched water table present. -- In protected bedrock areas (50 ft. of soil & shale cap), well depth is 75-100 ft. -- In protected bedrock areas overlain with 50 ft. of sand or gravel, well depth is greater than 150 ft. -- In shallow bedrock areas (25-50 ft. soil & shale cap), well depth greater than 200 ft. -- In Karst areas, well depth is greater than 1,000 ft., if aquifier is "confined." -- OTHER 9	MODERATE: -- Soils rich to moderate in organic matter (3.0 to 1.5%). -- Slow to moderate percolation in clay loams or silts. -- Perched water table present. -- In protected bedrock areas, well depth is 30-74 ft. -- In protected bedrock areas overlain with 50 ft. of sand or gravel, well depth is 100-149 ft. -- In shallow bedrock areas, well depth is 50-199 ft. -- In Karst areas, well depth is 500-999 ft. -- OTHER 6	CONSIDERABLE: -- Soils moderate to low in organic matter (1.5 to 0.5%). -- Moderate to rapid percolation in silty loams, loams, or silts. -- In protected bedrock areas, well depth is 15-29 ft. -- In protected bedrock areas overlain with 50 ft. of sand or gravel, well depth is 50 - 99 ft. -- In shallow bedrock areas, well depth is 25-49 ft. -- In Karst areas, well depth is 100-499 ft. -- OTHER (4)	HIGH: -- Soils low to very low in organic matter (less than 0.5%) -- Rapid percolation in coarse textured loamy sands or sands. -- In protected bedrock areas, well depth is less than 15 ft. -- In protected bedrock areas overlain with 50 ft. of sand or gravel, well depth is less than 50 ft. -- In shallow bedrock areas, well depth is less than 25 ft. -- In Karst areas, well depth is less than 100 ft. -- OTHER 0	See animal waste, nutrients, pesticide, & salt "B" Field Sheets for practices

1. Add the circled Rating Item scores to get a total for the field sheet. TOTAL [30]
2. Check the ranking for this site based on the total field score. Check "excellent" if the score totals at least 40. Check "good" if the score falls between 26 and 39, etc. Record your total score and rank (excellent, good, etc.) in the upper right-hand corner of the field sheet. If a Rating Item is "fair" or "poor," find the practices in the right-hand column to help remedy the conditions.

RANKING Excellent (40-46) [ ] Good (26-39) [30] Fair (10-25) [ ] Poor (9 or less) [ ]

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